UPDATED SIZE, DEMOGRAPHIC & HEALTH CHARACTERISTICS OF THE U.S. POPULATION WITH REDUCED ACCESS TO NON-EMERGENCY MEDICAL TRANSPORTATION & PRACTICAL IMPLICATIONS

by

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INTRODUCTION

Every year, millions of Americans miss or are delayed in accessing non-emergency medical (NEM) appointments due to transportation-related issues. Specifically, these individuals may not have access to a personal vehicle and/or public transit to access NEM appointments, may have a disability and have difficulty securing needed transportation to NEM appointments, may not be able to afford the direct or indirect expense of traveling to an NEM appointment, and/or may not be able to afford the travel time or distance required to make a NEM appointment. Missed or delayed NEM appointments are costly, not only for the medical practices and insurance companies who depend on patient attendance, punctuality, and low readmission rates, but also for the individual, whose condition may become emergent if not treated in a timely and appropriate manner.

Research indicates that the most at-risk populations for missed or delayed access to NEM appointments due to transportation are disproportionately older, low-income, and minority populations. These same populations are also at a higher risk for many chronic conditions that require frequent NEM appointments. Thus, difficulty in accessing NEM care due to transportation perpetuates a cycle of poor health outcomes in these populations that is difficult to overcome at the individual level. Instead, built environment-level change, including improvements to access and availability of NEM transportation networks, needs to occur in order to increase attendance to NEM appointments for the population that is at highest risk of missing these appointments. Ultimately, such change will lead to overall improved and sustainable long-term health outcomes for these populations as well as reduced costs for the medical community and the individual.

The purpose of this paper is to build upon existing research and provide a quantitative update of the current size of the U.S. population that is delayed in accessing NEM care due to issues of transportation, as well as the demographic and health characteristics of this population. The reasons for this report are threefold:

1. The most recent estimate of the size of the U.S. population lacking access to non-emergency medical transportation (NEMT) is a report authored by Hughes-Cromwick et al. in 2005. Since the Hughes-Cromwick report was published, the size estimate mentioned has been cited widely and consistently in articles, news reports, government papers, insurance company websites, and many other sources as recently as 2018. At this point, the data and estimates provided in the 2005 report are over 15 years old and need to be updated in order to continue to be relevant and effective in making the case for increased and equitable NEMT options in the U.S.
2. Similarly, the demographic and health characteristics highlighted in the 2005 report are also outdated and need to be re-assessed in order to understand the scope of the disparity in access and need for NEMT.
3. Finally, in order to recommend relevant, appropriate, and targeted solutions for the populations most in need of access to NEMT, it is important to have updated metrics of the size of the issue and characteristics of the at-risk populations.

It is hypothesized that the size of the U.S. population that is delayed in accessing NEM care due to issues with transportation is larger than the 2005 estimate and exceeds natural population growth. It is also suspected that the demographic and health characteristics of this population has stayed relatively constant over the past 15 years, indicating that more effective and realistic measures need to be taken to ensure that at-risk populations that miss or are delayed in accessing NEM appointments due to transportation are able to consistently receive the care that they need. This will ultimately save money for the health community and individual, and lead to more sustainable and improved health outcomes for this, and the total U.S. population.

Background

The 2005 Hughes-Cromwick Et Al. Study

In 2005, Hughes-Cromwick et al. published a study in the *Transportation Research Record: Journal of Transportation Research Board* exploring the cost-effectiveness of access to nonemergency medical transportation (NEMT) in the U.S. population. In order to assess both the cost burden of lack of access to NEMT to society and the individual, as well as the benefit of potential solutions, Hughes-Cromwick et al. first aimed to provide a national estimate of the size, socio-demographic and health characteristics of the "transportation disadvantaged" population that misses or is delayed in accessing NEM due to issues with transportation. Using a triangulation method of analysis, the estimated size of the U.S. population with lack of access to NEMT was found to be approximately 3.6 million Americans. This population was identified as largely older, minority, low income, with lower educational attainment, and located in rural areas with a disproportionate prevalence of acute and chronic medical conditions.[i]

The size of the population of Americans lacking NEMT, and the demographic and health characteristics of this population, were important for Hughes-Cromwick et al. to understand prior to exploring the cost and benefits of existing NEMT in the U.S. and potential improvements. Since 2005, when the study was published, the size estimate and characteristics of this population have been used in countless articles and arguments for more effective and equitable policies and solutions to access to NEMT, especially for at-risk communities. However, the data in the Hughes-Cromwick et al. study is currently over 15 years old and needs to be updated in order to provide reliable and important context for current and future NEMT policy, opportunities, and solutions.

Definition of The Target Population for This Study

The 2005 Hughes-Cromwick et al. study provided a definition for the population that misses or is delayed in accessing NEM care due to lack of access to NEMT that included individuals unable to transport themselves or unable to purchase available transportation services, such as buses or taxis, due to low income, physical or mental disability, inability to drive, geographic isolation or another reason.[ii] While similar in nature to this definition, **the target population for this study is based in research and includes the subset of the U.S. population that is delayed in accessing NEM care due to issues with transportation**. Such issues may include:

1. Lack of physical access to a personal vehicle and/or public transit;
2. Disability or difficulty securing needed transportation;
3. The expense of transportation;
4. The time or distance required to access an NEM appointment.

Lack of Physical Access to a Personal Vehicle and/or Public Transit

The American Association of State Highway Transportation Officials (AASHTO) reports that about 10 million households throughout the country lived without a vehicle in 2013.[iii] While 90% of that population were located in urban centers with a density of over 10,000+ persons per square mile, 10% lived in areas with less density and less likelihood of having access to public transit.[iv] In a prior, yet widely cited Brookings Institute report from 2011, an analysis of American Community Survey and transit provider data in 100 of the America's largest cities found that approximately 7.5 million households in the nation's largest cities do not have access to a private vehicle, of which over 700,000 households lacked access to transit, including 263,000 suburban households.[v]

In a 2013 meta-analysis exploring the transportation barriers to healthcare access, of nine studies that assessed the influence of vehicle access – either owning a vehicle or having access to one through friends or family – all found a positive relationship, indicating that transportation is an important factor in access to NEM care.[vi] In fact, the same analysis found that transportation issues can impact healthcare access by as little as 3% and as much as 67%.[vii]

Disability and Difficulty Securing Needed Transportation

The Bureau of Transportation Statistics reports that approximately 3.5 million people in the U.S., or about one percent of the total population, never leave their homes.[viii] More than half of these homebound individuals (1.9 million) are living with a disability, and almost a third of those individuals (about 550,000) report having difficulty getting transportation to desired destinations.[ix] Americans with disabilities are more likely to have difficulty getting the transportation they need than individuals without disabilities, with approximately 33% of Americans with disabilities noting problems with no or limited access to public transportation, 26% noting issues with not having a car, 17% noting that their disability makes transportation hard to use, and 12% noting that not having someone to depend on for transportation is a problem.[x]

Medicaid supports individuals with disabilities to get to medical appointments, yet still transportation barriers prevent 7.6% of National Health Interview Survey (NHIS) respondents using Medicaid from attaining NEM care.[xi] Often, this may be due to higher demand than the current supply of Medicaid NEMT. This is in comparison to 0.6% of NHIS respondents who had private insurance and had difficulty accessing NEM appointments due to transportation issues.[xii]

The Expense of Transportation

The cost of transportation to NEM care is a less studied barrier to healthcare, yet is a concern acknowledged in many studies of healthcare access. In a 1997 study by Giambruno et al. that looked at barriers to access to healthcare for participants in Head Start programs, cost of transit was noted as a concern by 63% of the 157 Head Start programs surveyed.[xiii] In a separate 2003 study conducted by Kruzich et al., 28% of caregivers looking after children suffering from issues with mental health noted the cost of transportation was a barrier to access to healthcare.[xiv] While cost of transportation to NEM care is a noted and logical barrier to healthcare access, further research is needed to confirm the extent of this barrier on healthcare access.

The Time or Distance Required to Access an NEM Appointment

Evidence that travel time and distance to NEM care are barriers to healthcare access is mixed. In a meta-analysis of transportation barriers to healthcare access from 2013, six studies found that distance to healthcare providers was a noted obstacle in seeking out care.[xv] However, almost all of these studies gathered data through survey methodology as opposed to measured distance. Three additional studies in the meta-analysis looking at the effect of distance on healthcare access found no relationship. These mixed results provide the basis for an argument that regardless of actual distance, perceived distance and travel time to NEM appointments is clearly linked to access to NEM care.[xvi] Given that many individuals with lack of access to NEMT are from low income, minority, and rural populations, travel distance to NEM appointment becomes a more realistic concern.[xvii]

Characteristics of The Target Population From The Literature

The 2005 Hughes-Cromwick et al. study provided a descriptive analysis of NHIS and MEPS data indicating demographic, socio-economic and health characteristics of the population that lacks access to NEMT. In the study, it was found that the previously mentioned population is disproportionately low-income, female, and

older, as well as has a higher minority representation and less educational attainment. Additional research supports these findings and is applicable to the target population defined for this study: the portion of the U.S. population that is delayed in accessing NEM care due to issues with transportation. It is hypothesized that the current study findings will corroborate the following research.

Low Socioeconomic Status

Socioeconomic status is largely linked to transportation barriers to NEM care in the literature. In a 2001 analysis of National Household Travel Survey data by Pucher and Renne, 26.5% of households with incomes less than $20,000 per year had no motor vehicle compared with only 5% of households in the next highest income bracket.[xviii] In a study by Rask et al. investigating barriers to healthcare access for urban, low-income adults in Atlanta, lack of transportation was identified as an obstacle for 35.8% of the 3,897 patients studied and was an independent predictor of delays to medical care.[xix] While many individuals who lack access to a personal vehicle do have access to public transit, a 2012 study of low-income, largely immigrant patients to four public clinics in New York City found that patients who rode the bus to the doctor were twice as likely as car users to report missing or needing to reschedule appointments.[xx] Another study of low-income adults in Montgomery County, Ohio found that approximately one third of study participants perceived finding transportation to medical appointments either hard (16%) or very hard (14.5%), with difficulty finding transportation to medical care significantly correlated with poverty status.[xxi]

When adults lack transportation to NEM care, this often can lead to delayed or missed appointments for children as well. In a study conducted by the Children's Health Fund in 2001, it was found that 9% of children in families of less than $50,000 (almost four million children) miss medical appointments due to issues with transportation.[xxii] [xxiii]

Minority Groups

Ample evidence exists indicating that minority populations are at greater risk for missed or delayed NEM care due to issues with transportation. In a 2005 Hughes-Cromwick et al. article complementing the larger 2005 study, it was noted that between 10% to 20% more members of racial minority groups are transportation disadvantaged in comparison to the White population in the United States.[xxiv] Racial and ethnic minority groups also are found to rely more heavily on public transportation, with Blacks almost six times as likely as Whites to take transit trips and Hispanics about three times as likely to take transit.[xxv] According to the Rask et al. study, patients that took public transportation to medical appointments were more likely to not have a regular source of medical care, and those without private transportation were more often delayed in arriving to appointments.[xxvi] In a 1997 study by Guidry et al., Black and Hispanic patients with cancer were found to consistently report issues with transportation as potential major problems for accessing care.[xxvii] In a 2010 study by Johnson et al. investigating delays in care for American Indian or Alaska Native veterans, it was found that American Indian or Alaska Native veterans had twice the odds of being delayed accessing medical appointments and almost three times the odds of having transportation problems in comparison to White veterans.[xxviii]

With regards to children's access to NEM care, a 2006 study, conducted by Yang et al., of patients at a Texas clinic that primarily serves minority and low-income patients, found that the clinic's daily missed appointment rate was often as high as 43%.[xxix] Of those patients that missed appointments, only 58% had access to a car compared with 82% of those that kept their appointments. Further, approximately 50% of study participants noted that transportation was the reason for missed appointments compared with 30% of patients who kept their appointments.[xxx] In a meta-analysis of barriers to health care for Latino children conducted by Flores and Vega, at least three separate studies of Latino mothers highlighted transportation as

a significant barrier to care. One study found that Latino mothers cited transportation as a barrier to healthcare 26% more often than White mothers.[xxxi]

Age

Research indicates that the older adult population, over 65 years, as well as the child population in the U.S., often has difficulty accessing medical care due to transportation. In a 2004 study by Fitzpatrick et al., 4855 study participants over 65 years answered a survey about healthcare access barriers and one in five noted that transportation was an important barrier to access.[xxxii] In an analysis of existing resources for family caregivers of older adults in California, transportation was noted as a considerable gap in service.[xxxiii] Part of the reason older adults disproportionately suffer from transportation barriers to healthcare access is due to the fact that older adults make up a greater percentage of the population that does not drive. According to a 2004 study by Bailey, approximately one in five U.S. adults over the age of 65 no longer drives, and in turn, this population takes 15% fewer trips to the doctor.[xxxiv] The reasons that older adults do not drive have to do with medical concerns such as vision problems, disability or limited functionality, as well as nonmedical concerns such as fear of driving at night or fear of being in an accident.[xxxv]

As mentioned previously, children in the U.S. also suffer largely from reduced access to NEM care due to transportation. This is due often to difficulties with parents accessing transportation to take their child to medical appointments.

Medical Conditions

In addition to the demographic and socioeconomic disparities present in the U.S. population that is delayed in accessing NEM care due to issues of transportation compared with the total U.S. population, the 2005 Hughes-Cromwick et al. study found that adults that lack access to NEMT suffered from a greater percentage of multiple health conditions than the general U.S. population. Of those conditions most prevalent, the majority were chronic conditions such as arthritis, recurring pain, aching joints, and depression. It is notable that mental health issues were also prevalent in this population. In the child population that is delayed in accessing NEM care due to issues of transportation, 32% had multiple health conditions in comparison to 14% who did not miss care. Three of the five most prevalent conditions for children who missed medical appointments due to transportation were found to be chronic, including ADHD or ADD, asthma, and frequent headaches.[xxxvixxxvii]

Why Access to NEMT Matters

Transportation to NEM appointments is an essential step in the maintenance and improvement of long-term health outcomes in the U.S., as well as in the reduction of overall healthcare costs to the individual and the medical community.

Health Case

Missed or delayed NEM appointments due to transportation can lead to worsened health outcomes and exacerbation of health needs. As mentioned by Hughes-Cromwick et al. in 2005, lack of transportation to NEM appointments may result in less immunizations, lack of prenatal care, patients not returning for necessary check-ups, lack of assessment and diagnosis of possible important health conditions, among other consequences.[xxxviii] NEM appointments are also important for the care of chronic health conditions. Missed NEM appointments for chronic conditions can lead to a lapse in the renewal of important prescriptions, delayed or lack of assessment of treatment plans which may include necessary changes for escalation or de-

escalation of care, delayed or lack of assessment of health complications, among other consequences.[xxxix] Because the population that is delayed in accessing NEM care due to issues of transportation due is disproportionately minority, low-income, low educational attainment, and older as well as disproportionately burdened by chronic disease, reduced or lack of access to transportation to NEM appointments in this population perpetuates a cycle of poor health in the United States.

Economic Case

Delayed or missed NEM appointments often leads to unnecessary healthcare costs for both the individual and the U.S. healthcare system. Specifically, delays in addressing individual health concerns may lead to costly medical expenses for the individual in the way of additional visits to the doctor, lack of a consistent primary care physician to monitor health progress and ensure quality of care, as well as possible emergency room visits or hospitalizations.[xl]

With regards to the healthcare field, delays in NEM care can lead to costs associated with rescheduling of appointments, loss of productivity and administrative costs due to missed appointments, ambulance operation costs, and emergency room operations and administration costs.[xli] In a study looking specifically at a clinic that does outpatient endoscopy procedures, it was found that missed appointments may cost the clinic between $475 and $1,1019 a day from loss of physician productivity and administrative work.[xlii] In a systematic review from 2014, it was noted that $4.4 billion per year could be saved across the United States if non-urgent emergency department visits were covered in clinics and primary care facilities.[xliii] A Florida State University study concluded that if 1 percent of medical trips to the emergency room could be avoided, the return on investment to the state would be 1,108% or about $11.08 for each dollar the state invested in an NEMT program.[xliv] Overall, delayed or missed NEM appointments due to transportation are costly both for the individual as well as the healthcare community. Innovative solutions to NEMT and access to transportation to NEM appointments, especially for the population most at-risk for missing or being delayed in accessing care, are important ways to reduce the economic burden of missed or delayed NEM appointments.

The Current Study

Improved access to transportation for NEM appointments is an essential step in ending the cycle of poor health outcomes in the target population, as well as is key to reducing healthcare costs in the U.S. Prior to discussion of solutions to increase access to transportation to NEM appointments however, it is important to understand the current size of the U.S. population that is delayed in accessing NEM care due to issues of transportation (the target population), as well as the demographic and health characteristics of this population. It is hypothesized that the size of this population has grown non-linearly since the Hughes-Cromwick et al. study was published in 2005, but demographic and health characteristics are likely to be similar to those identified a decade and a half prior.

Methodology

The following provides an overview of the methods used to determine an updated estimate of the target population in 2015, as well as the methods for determining the demographic and health characteristics of this population.

Estimation of Number of Americans That are Delayed in Accessing NEM Care Due to Issues With Transportation

To estimate the number of Americans that are delayed in accessing NEM care due to issues of transportation in 2015, an updated version of the methodology used in the 2005 Hughes-Cromwick et al. study was applied. Two national datasets from the U.S. Department of Health and Human Services, the National Health Interview Survey and the Medical Expenditure Panel Survey, were used to complete the estimation analysis. These datasets provide nationally representative data and each include surveys questions that ask respondents to identify the reasons for missed or delayed medical appointments.

National Health Interview Survey

The National Health Interview Survey (NHIS) is an annual, national survey conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics. The NHIS is the principle source of information on the health of the U.S. civilian, noninstitutionalized population and is intended to monitor the health of the U.S. population and track progress towards achieving national health objectives.[xlv] A broad range of health topics are covered in the survey and data is collected through personal household interviews of between 35,000 to 40,000 households or approximately 75,000 to 100,000 individuals each year.

The NHIS includes a number of questionnaires that assess different aspects of the health of the current U.S. population. The two sections of the NHIS relevant for the current analysis are the Sample Adult and the Sample Child files. The Sample Adult section collects information from a representative sub-sample of adults, 18 years and older, on topics that cover socio-demographic characteristics, health conditions, health status, health behaviors, and health access and utilization. The Sample Adult file includes 36,672 records with one record for each participant.

The Sample Child section collects information from a sub-sample of youth, ages 0 through 17 years, on topics that cover conditions, activity and health status and health care access and utilization. The Sample Child file includes 12,291 records with one record for each participant. These sample sections of the NHIS allow for more granular information to be collected, including the variable of interest in this project – specific reasons for delays getting medical care.

Variables of Interest

In the 2005 Hughes-Cromwick et al. study, researchers used 2001 – 2002 NHIS adult sample and child sample data to complete their analysis. Specifically, answers to two questions, one for each dataset, asking whether transportation was the cause of delay in received medical care in the past 12 months was combined to estimate the total number of individuals in the U.S. who missed or delayed medical care due to issues with transportation.[xlvi]

For the purposes of the current analysis, 2015 NHIS adult sample and child sample data were used, as they represent the most recent datasets published by the NHIS with complete data analysis information. For the 2015 NHIS Sample Adult Questionnaire, the final variable name used for analysis was AHCDLYR5, and for the 2015 NHIS Sample Child Questionnaire, the final variable used was CHCDLYR5: [xlvii] [xlviii] Both variables refer to the same question, previously used in the Hughes-Cromwick et al. study, and listed below.

> **There are many reasons people delay getting medical care. Have you delayed getting care for any of the following reasons in the PAST 12 MONTHS … you didn't have transportation?**
>
> No transportation, past 12 m

1	Yes
2	No
7	Refused
8	Not ascertained
9	Don't know[xlix]

Analysis

Following the methodology established by Hughes-Cromwick et al. in 2005, both the NHIS Adult and Child Sample datasets were downloaded from the National Center for Health Statistics website.[l] The statistical software, SAS 9.4 English, was used to isolate both variables of interest from the Adult and Child Sample files and apply the appropriate weights to achieve national level estimates. Both of the Adult and Child sample weights included design, ratio, non-response, and post-stratification adjustments for their respective samples. The weight variable for the Sample Adult was WTFA_SA and the weight variable for the Sample Child was WTFA_SC.

Once each dataset was successfully imported into SAS, national population weights were applied to each variable in each dataset (see the weighted SAS code used in Appendix A).[li] The SAS output provides weighted frequency percentages for each categorical response (yes, no, refused, not ascertained, don't know) of both variables for the Sample Adult and Child data. These percentages were then applied to the 2015 U.S. population to produce representative estimates of the number of U.S. adults and children who were delayed in accessing NEM care due to issues with transportation.

Medical Expenditure Panel Survey

The Medical Expenditure Panel Survey (MEPS) is a nationally representative survey of the U.S. civilian noninstitutionalized population conducted out of the U.S. Department of Health and Human Services' Agency for Healthcare Research and Quality. The survey is a set of large-scale interviews with families and individuals, their medical providers and employers from across the country. MEPS collects data on a range of health topics including specific health services that Americans use, how frequently they use them, cost of services, and health insurance information, among others. There are two main components of the MEPS survey, the Household Component and the Insurance Component.[lii] The Household Component (HC) is the portion of MEPS that is used in the current analysis. Data for the HC component is collected through several rounds of interviews conducted over two calendar years and in 2015 included 13,800 families and 33,893 individuals.[liii]

Variables of Interest

In the 2005 Hughes-Cromwick et al. study, researchers used 2001 MEPS-HC data to complete their analysis. From the 2001 dataset, responses to the following question were assessed.

Anyone have difficulty obtaining care? If yes, then what is the main reason for the difficulty?

Of the fourteen possible categorical responses, three (medical care too far away, cannot drive/no car/no public transportation, and too expensive to get there) were specific to transportation and used to determine the final estimate of Americans that missed or were delayed in receiving medical care due to issues with transportation. Following this question, the 2001 MEPS allowed respondents to choose a secondary reason why they were having difficulty obtaining care. It is important to note that the analysis only counted respondents once if they provided a transportation-related answer for both their primary and secondary reasons.[liv]

For the purposes of the current project, 2015 MEPS-HC data was used to complete the analysis; specifically, MEPS-HC-183: MEPS Panel 19 longitudinal data.[lv] Two separate questions related to delayed access to NEM care due to issues with transportation were applicable for this analysis (see the full two questions in Appendix B). The first of these questions asked:

> **In the last 12 months, was anyone in the family *unable* to obtain medical care, tests, or treatments they or a doctor believed necessary? [If yes] Which of these best describes the main reason [that person was] unable to get medical care, tests, or treatments {you/he/she} or a doctor believed necessary?**

Between 2001 and 2015, the MEPS survey design and interview guides changed and unfortunately, the categorical responses listed in the 2001 data were made less specific with regards to transportation. Further, the 2015 MEPS-HC questionnaire no longer asks for primary and secondary reasons for difficulty in obtaining medical care. Instead, only the main reason is requested from respondents. Of the categorical responses provided for the question above, two were presumed to include transportation for the purposes of this analysis – "problems getting to the doctor's office" and "didn't have time or took too long." The same categorical response options were provided for the second question.

The second question in the 2015 MEPS-HC dataset that relates to problems with accessing healthcare due to transportation asked:

> **In the last 12 months, was anyone in the family *delayed* to obtain medical care, tests, or treatments they or a doctor believed necessary? [If yes] Which of these best describes the main reason [that person was] unable to get medical care, tests, or treatments {you/he/she} or a doctor believed necessary?**

The previous two questions were asked during two rounds of interviewing over the two-year panel survey period (rounds 2 and 4) and represent answers from two different samples. [lvi] [lvii] In the MEPS-HC data file, this is represented as four different variables: MDUNRS2 and MDUNRS4 (unable to obtain medical care), and MDDLRS2, and MDDLRS4 (delayed in obtaining medical care).[lviii]

Analysis

Following the methodology established by Hughes-Cromwick et al. in 2005, the 2015 MEPS-HC-183: MEPS Panel 19 Longitudinal Data File was downloaded from the Agency for Healthcare Research and Quality website.[lix] The statistical software, SAS 9.4 English, was used to isolate all four variables of interest and apply the appropriate weights to achieve national level estimates. The weight applied to each variable included non-response and post-stratification adjustments for their respective samples.[lx] The weight variable for the MEPS-HC data was LONGWT.[lxi]

Once the MEPS-HC was successfully imported into SAS through a transport program, SAS code was used to apply the weight variable to each variable of interest.[lxii] The SAS output provides weighted frequencies for each of the 12 categorical responses provided in each of the questions. The two responses of interest – "problems getting to the doctor's office" and "didn't have time or took too long" – were added with each variable and across each variable for one composite estimate of those Americans who missed or were delayed in accessing medical care due to issues with transportation.

Demographic and Health Characteristics of U.S. Adults Who are Unable or Delayed in Obtaining NEM Care Due to Transportation

Demographic Characteristics

The 2015 NHIS Sample Adult and Child data includes not only healthcare access and utilization information, but also data related to the demographic and health characteristics of respondents.

Variables of Interest

In the 2005 Hughes-Cromwick et al. study, researchers used 2001 – 2002 NHIS Sample Adult and Child data to complete an analysis of socio-economic and demographic characteristics of respondents. Specifically, the following variables were considered: income, sex, race, educational attainment, age, and urban vs. rural. The socio-economic and demographic profile identified was used to better understand the characteristics of the population that is unable or delayed in accessing NEM care due transportation and inform cost-benefit estimates.

In the 2015 NHIS Sample Adult dataset used for this project, socio-economic variables including income and educational attainment, as well as the urban/rural divide were excluded from the original survey and thus were not available in the dataset. For this reason, this project focused on updating and analyzing only the demographic variables available in the 2015 data, which for both datasets included:

- SEX (Sex): Male, Female
- MRACRPI2 (Race coded to single/multiple race group): White, Black or African American, Indian (American)/Alaska Native, Asian Indian, Chinese, Filipino, Other Asian, Primary race not releasable, Multiple race, no primary race selected
- AGE_P (Age): 18 and over
- REGION (Region): Northeast, Midwest, South, West

Analysis

The previous methodology described for analyzing NHIS Sample Adult and Child datasets was used for this analysis. The statistical software, SAS 9.4 English, was used to isolate each variable of interest in both the Adult and Child Sample files and apply the appropriate weights to achieve national level estimates. Both of the adult and child sample weights included design, ratio, non-response, and post-stratification adjustments for their respective samples. The weight variable for the Sample Adult was WTFA_SA and the weight variable for the Sample Child was WTFA_SC.

Once each dataset was successfully imported into SAS, SAS code recommended by the 2015 National Health Interview Survey (NHIS) Survey Description was used to apply the weight variable to each dataset.[lxiii] In addition to applying national weights, in order to isolate the demographic characteristics of only those individuals who missed or were delayed in accessing NEM care due to transportation issues, a crosstabs table was developed in SAS (see full SAS code in Appendix D).

The resulting SAS output provides weighted frequencies for each categorical response to each variable for both the Sample Adult and Child data. The ratio of frequencies between the population who misses or is delayed in accessing NEM care to transportation and the total population is determined and highlights the standardized difference between the variables in each population.

Health Characteristics

The 2015 NHIS Sample Adult and Child data includes health characteristics of respondents and allows for granular analysis of these characteristics for the population who is delayed in accessing NEM care due to issues with transportation.

Variables of Interest

In the 2005 Hughes-Cromwick et al. study, researchers used 2001 – 2002 NHIS Sample Adult and Child data to complete an analysis of the health characteristics of respondents. For the Sample Adult data, Hughes-Cromwick et al. looked at 43 health-condition variables in total, 38 of which were physical conditions and 5 were psychological problems. For the Sample Child data, researchers looked at 24 health variables, most of which are different from those considered for the Sample Adult analysis.

In the 2015 NHIS Sample Adult dataset, 16 of the variables previously analyzed in the 2006 study were unavailable, including: recurring pain, insomnia, excessive sleepiness, dental problems, medication allergies, severe sprains, food/odor allergies, irritable bowel syndrome, menstrual problems, thyroid problems, gynecological problems, menopausal problems, neuropathy, multiple sclerosis, prostate, and Parkinson's Disease. Eight additional health variables were also added to this project including: Carpal Tunnel Syndrome, Chronic Bronchitis, Felt Like Everything was an Effort, Heart Attack, Seizure Disorder/Epilepsy, Emphysema, Angina Pectoris, and Crohn's Disease/Ulcerative Colitis.

In the 2015 NHIS Sample Child dataset, the following variables previously included in the 2006 study could not be analyzed due to missing data: congenital heart disease, mental retardation, seizures, muscular dystrophy, other developmental delays, and sickle cell anemia. Three additional health variables were added to the current analysis: diabetes, other heart condition, and chicken pox.

Analysis

The previous methodology described for analyzing NHIS Sample Adult and Child datasets was used for this analysis. The statistical software, SAS 94 English, was used to isolate each variable of interest in both the Adult and Child Sample files and apply the appropriate weights to achieve national level estimates. Both of the adult and child sample weights included design, ratio, non-response, and post-stratification adjustments for their respective samples. The weight variable for the Sample Adult was WTFA_SA and the weight variable for the Sample Child was WTFA_SC.

Once each dataset was successfully imported into SAS, SAS code recommended by the 2015 National Health Interview Survey (NHIS) Survey Description was used to apply the weight variable to each dataset.[lxiv] In addition to applying national weights, in order to isolate the health characteristics of only those individuals who missed or were delayed in accessing NEM care due to transportation issues, a crosstabs table was developed in SAS (see full SAS code for both Sample Adult and Sample Child data in Appendix E).

The SAS output provides weighted frequencies for each categorical response to each variable for both the Sample Adult and Child data. The ratio of frequencies between the population that is delayed in accessing NEM care due to issues with transportation and the total population is determined and highlights the standardized difference between the variables in each population.[lxv]

FINDINGS

ESTIMATION OF NUMBER OF AMERICANS WITH REDUCED ACCESS TO NEM DUE TO TRANSPORTATION

NATIONAL HEALTH INTERVIEW SURVEY

The following table reflects the weighted frequency percentages that resulted from SAS analysis of the 2015 NHIS Sample Adult data (see original SAS output in appendix F), as well as the weight frequency of each categorical response using the 2015 national population estimate from the American Community Survey of 316,515,021 Americans.

Table 1: Adults Reporting Delays in Obtaining Medical Care Due to Transportation from 2015 NHIS

Response	Weighted Percentage	Weighted Frequency
Yes (delayed in access)	**1.41**	**4,462,862**
No	97.67	309,140,221
Refused/NA/Don't Know	0.92	2,911,938
Total	100	316,515,021

The following table reflects the weighted frequency percentages that resulted from SAS analysis of the 2015 NHIS Sample Child data (see original SAS output in appendix G), as well as the weight frequency of each categorical response using the 2015 national population estimate from the American Community Survey of 316,515,021 Americans.

Table 2: Children Reporting Delays in Obtaining Medical Care Due to Transportation from 2015 NHIS

Response	Weighted Percentage	Weighted Frequency
Yes (delayed in access)	**1.79**	**5,665,619**
No	98.04	310,311,327
Refused/NA/Don't Know	0.16	506,424
Total	99.99	316,515,021

In order to determine the total number of Americans that were delayed in obtaining medical care due to transportation in 2015, the weighted frequency "yes" responses for the Sample Adult and Sample Child datasets were added.

In total, the NHIS reports that 10,128,481 Americans were delayed in obtaining medical care due to transportation in 2015. This estimate is likely high due to possible double counting between children and adults if parents reported delays in obtaining medical care due to transportation in the adult survey for their children.

MEDICAL EXPENDITURE PANEL SURVEY

The following table resulted from SAS analysis of the 2015 MEPS-HC data and reflects the weighted frequency percentages of the two categorical responses to question AC34, as well as the weight frequency of each categorical response representative of the 2015 national frequencies (see original SAS output in appendix H).

Table 3: Americans Reporting Unable to Obtain Necessary Medical Care Due to Transportation-Related Reasons from the 2015 MEPS-HC

Round	Response	Weighted Percentage	Weighted Frequency
2	Problems getting to doctor's office	0.06	214,293
	Did not have time or took too long	0.06	203,020
4	Problems getting to doctor's office	0.07	235,807
	Did not have time or took too long	0.07	232,856

The following table reflects the weighted frequency percentages of the two categorical responses to question AC38, as well as the weight frequency of each categorical response representative of the 2015 national frequencies (see original SAS output in appendix I).

Table 4: Americans Reporting Delayed in Obtaining Necessary Medical Care Due to Transportation-Related Reasons from the 2015 MEPS-HC

Round	Response	Weighted Percentage	Weighted Frequency
2	Problems getting to doctor's office	0.18	570,488
	Did not have time or took too long	0.28	912,579
4	Problems getting to doctor's office	0.19	621,772
	Did not have time or took too long	0.25	806,881

In order to determine the total number of Americans that were either unable to obtain or delayed in obtaining medical care in part due to transportation in 2015, the weighted frequency responses in tables 3 and 4 were combined.

In total, MEPS reports that 3,793,696 Americans were unable or delayed in obtaining medical care due in part to transportation in 2015. This estimate is only slightly higher than the estimate reported in the 2005 Hughes-Cromwick et al. study and likely does not take into account the total increase in the issue of transportation in obtaining medical care. This in part may be due to the fact that in the 2015 version of the survey respondents were only able to choose their primary reason for being unable to obtain or delayed in obtaining medical care. If respondents had a second choice of reason, the frequency of transportation may be higher. Additionally, because transportation was not specifically included in the reasons listed for questions AC34 or AC38, it is possible that respondents did not think to report transportation and were instead persuaded towards another reason that was explicitly listed for them. This is a limitation of the 2015 dataset for the purposes of this study.

Final Estimation

If following Hughes-Cromwick et al.'s methodology from 2005, the NHIS and MEPS total estimates for the number of Americans unable or delayed in obtaining medical care due to transportation would be averaged in order to obtain the final estimate. However, due to substantial changes to the 2015 MEPS survey questions, effectively eliminating direct reference to transportation-related issues in access to NEM care, the NHIS total is the only estimate reported for the purposes of this study. It is important to remember that the NHIS estimate is high and above all, that the new total is just an estimate for 2015.

In total, the NHIS reports that 10,128,481 Americans were delayed in obtaining medical care due to issues with transportation in 2015. This estimate is approximately three times that provided in the 2005 Hughes-Cromwick et al. study and while some of the increase is due to natural population growth, there is still a growing issue of lack of transportation in obtaining non-emergency medical care. This is verified by calculating the ratio of each estimate of Americans who are unable or delayed in obtaining medical care to the U.S. population for each respective year. The ratio for the 2005 study is 0.013 and the ratio for the 2015 project is 0.032, indicating that it is likely that more than natural population growth contributed to the increase from 2005 to 2015.[lxvi]

Demographic Profile of Americans Who are Delayed in Accessing NEM Care Due to Issues With Transportation

Sample Adult Population

In order to gain a comprehensive understanding of the demographic characteristics of the population that is delayed in accessing NEM care due to issues with transportation (the target population), two separate analyses conducted. First, table 5 provides both unweighted and nationally-representative weighted percentages of the U.S. sample adult population that is delayed in accessing medical care due to transportation by demographic characteristic. The analysis indicates that a larger percentage of females, Indian (American) or Alaska Native and those individuals of multiple races, those from the Midwest, and older adults in the U.S. adult population experience delays in accessing medical care due to transportation.

Table 5: Percentages of the Sample Adult Population with Certain Demographic Characteristics Who Answered Yes to Experiencing Delays to Medical Care Due to Transportation from the 2015 NHIS

	Unweighted Percentage (Population that answered yes to AHCDLYR5/Total Sample Population)	Weighted Percentage (Population that answered yes to AHCDLYR5/Total Sample Population)
Sex		
Men	1.73%	1.29%
Women	2.74%	2.31%
Race		
White	1.92%	1.53%
Black or African American	3.75%	1.53%
Indian (American), Alaska Native	8.69%	7.16%
Asian Indian	0.47%	0.29%
Chinese	1.62%	0.73%
Filipino	2.55%	1.64%
Other Asian	1.85%	1.14%
Primary race not releasable	3.91%	2.63%
Multiple race, no primary race selected	6.98%	3.18%
Region		
Northeast	2.11%	1.61%
Midwest	2.35%	2.11%
South	2.28%	1.71%

West	2.34%	1.89%
Age		
18-24 Years	2.35%	1.51%
25-34 Years	1.85%	1.52%
35-54 Years	2.24%	1.73%
55-64 Years	2.79%	2.42%
65+ Years	2.28%	1.67%

Table 6 details the demographic characteristics of the specific U.S. adult population that is delayed in accessing NEM care due to transportation rather than the percentages of the adult population that are delayed in obtaining NEM care due to transportation by demographic characteristic. The analysis indicates that American adults who experience delays in accessing medical care due to transportation are disproportionately female; minority, especially Black or African American and Indian (American), Alaska Native; from the South; and older, especially in the age group 55-64 years.

Table 6: Demographic Characteristics of Sample Adults Who Answered Yes to Experiencing Delays to Medical Care Due to Transportation Compared to the Total Sample Adult from 2015 NHIS

	Yes to AHCDLYR5 Resp. = 770	Yes to AHCDLYR5 Resp. = 4,417,476	Total Sample Resp. = 33,672	Total Sample Resp. = 242,500,657
	n (%)	Weighted n (%)	n (%)	Weighted n (%)
Sex				
Male	260 (34%)	1,510,686 (34%)	15,071 (45%)	116,875,168 (48%)
Female	510 (66%)	2,906,790 (66%)	18,601 (55%)	125,625,489 (52%)
Race				
White	501 (65%)	2,952,842 (67%)	26,114 (78%)	193,047,618 (80%)
Black or African American	180 (23%)	1,078,176 (24%)	4,804 (14%)	30,602,639 (13%)
Indian (American), Alaska Native	41 (5%)	204,196 (4.6%)	472 (1.4%)	2,852,293 (1.2%)
Asian Indian	2 (0.3%)	9,935 (0.2%)	423 (1.3%)	3,435,522 (1.4%)
Chinese	7 (0.9%)	21,811 (0.5%)	431 (1.3%)	2,990,619 (1.2%)
Filipino	12 (1.5%)	53,951 (1.2%)	470 (1.4%)	3,289,766 (1.4%)
Other Asian	13 (1.7%)	55,426 (1.3%)	701 (2.1%)	4,870,059 (2%)
Primary race not releasable	5 (0.6%)	17,937 (0.4%)	128 (0.4%)	682,616 (0.3%)
Multiple race, no primary race selected	9 (1.2%)	23,202 (0.5%)	129 (0.4%)	729,525 (0.3%)
Region				
Northeast	118 (15%)	679,671 (15%)	5,580 (17%)	42,320,172 (17%)
Midwest	167 (22%)	1,145,233 (26%)	7,102 (21%)	54,366,785 (22%)
South	266 (35%)	1,536,709 (35%)	11,646 (35%)	90,015,312 (37%)
West	219 (28%)	1,055,863 (24%)	9,344 (28%)	55,798,388 (23%)
Age				
18-24 Years	68 (8.8%)	451,199 (10%)	2,891 (8.6%)	29,862,548 (12%)
25-34 Years	107 (14%)	647,637 (15%)	5,782 (17%)	42,681,047 (18%)
35-54 Years	243 (32%)	1,434,431 (32%)	10,850 (32%)	83,068,195 (34%)
55-64 Years	161 (21%)	975,816 (22%)	5,771 (17%)	40,387,461 (17%)
65+ Years	191 (25%)	777,686 (18%)	8,378 (25%)	46,501,406 (19%)

Sample Child Population

Table 7 provides both unweighted and nationally representative weighted percentages of the U.S. sample child population that is delayed in accessing medical care due to transportation by demographic characteristic. The analysis indicates that of the entire U.S. population, those children that experience delays in accessing medical care due to transportation are disproportionately female, Black or African American or Indian (American) or Alaska Native, from the South, and in the age group of 0-4 years.

Table 7: Percentages of the Sample Child Population with Certain Demographic Characteristics Who Answered Yes to Experiencing Delays to Medical Care Due to Transportation from the 2015 NHIS

	Unweighted Percentage (Population that answered yes to CHCDLYR5/Total Sample Population)	Weighted Percentage (Population that answered yes to CHCDLYR5/Total Sample Population)
Sex		
Men	1.68%	1.53%
Women	1.97%	2.07%
Race		
White	1.60%	1.45%
Black or African American	3.13%	3.67%
Indian (American), Alaska Native	4.78%	3.07%
Asian Indian	0.48%	0.22%
Chinese	0.00%	0.00%
Filipino	0.49%	0.53%
Other Asian	1.08%	0.78%
Primary race not releasable	2.70%	4.96%
Multiple race, no primary race selected	0.64%	1.99%
Region		
Northeast	1.59%	1.34%
Midwest	1.69%	1.83%
South	2.11%	2.06%
West	1.70%	1.64%
Age		
0-4 Years	1.82%	2.13%
5-9 Years	1.81%	1.70%
10-14 Years	1.78%	1.56%
15-17 Years	1.90%	1.79%

Table 8 details the demographic characteristics of the subset of the U.S. child population, age 0-17 years, that is unable or delayed in obtaining NEM care due to transportation. This analysis indicates that American children who experience delays in accessing medical care due to transportation have similar demographic characteristics as the adult population detailed in Table 6, with one notable difference. While there was no geographic disparity in the adult population that is unable or delayed in obtaining NEM care due to transportation, children who are delayed in obtaining NEM care due to transportation are disproportionately located in the South.

Table 8: Demographic Characteristics of Sample Children Who Answered Yes to Experiencing Delays to Medical Care Due to Transportation Compared to the Total Sample Child from 2015 NHIS

	Yes to CHCDLYR5 Resp. = 224	Yes to CHCDLYR5 Resp. = 1,316,576	Total Sample Resp. = 12,291	Total Sample Resp. = 73,453,101
	n (%)	Weighted n (%)	n (%)	Weighted n (%)
Sex				
Male	107 (48%)	572,384 (43%)	6,352 (52%)	37,485,090 (51%)
Female	117 (52%)	744,192 (57%)	5,939 (48%)	35,968,011 (49%)
Race				
White	145 (65%)	808,673 (61%)	9,072 (74%)	55,608,609 (76%)
Black or African American	60 (27%)	426,330 (32%)	1,917 (16%)	11,608,060 (16%)
Indian (American), Alaska Native	11 (5%)	32,277 (2.5%)	230 (1.9%)	1,051,529 (1.4%)
Asian Indian	1 (0.4%)	2,273 (0.2%)	210 (1.7%)	1,031,710 (1.4%)
Chinese	0 (0%)	0 (0%)	151 (1.2%)	691,872 (0.9%)
Filipino	1 (0.4%)	4,939 (0.4%)	204 (1.7%)	925,811 (1.3%)
Other Asian	3 (1.3%)	11,131 (0.8%)	277 (2.3%)	1,429,654 (1.9%)
Primary race not releasable	2 (0.9%)	14,901 (1.1%)	74 (0.6%)	300,201 (0.4%)
Multiple race, no primary race selected	1 (0.4%)	16,052 (1.2%)	156 (1.3%)	805,655 (1.1%)
Region				
Northeast	30 (13%)	153,057 (12%)	1,888 (15%)	11,432,544 (16%)
Midwest	41 (18%)	307,882 (23%)	2,426 (20%)	16,867,548 (23%)
South	90 (40%)	568,273 (43%)	4,270 (35%)	27,592,485 (38%)
West	63 (28%)	287,364 (22%)	3,707 (30%)	17,560,524 (24%)
Age				
0-4 Years	62 (28%)	422,709 (32%)	3,410 (28%)	19,843,331 (27%)
5-9 Years	58 (26%)	349,564 (27%)	3,205 (26%)	20,541,378 (28%)
10-14 Years	59 (26%)	321,903 (25%)	3,309 (27%)	20,624,865 (28%)
15-17 Years	45 (20%)	222,400 (17%)	2,367 (19%)	12,443,527 (17%)

Health Characteristics of U.S. Population Delayed in Accessing NEM Care Due to Issues with Transportation

Sample Adult Population

Table 9 provides both the unweighted and weighted percentage of the U.S. sample adult and total population that experience one of 34 medical conditions and are also delayed in accessing NEM care due to issues with transportation. The data indicates that a disproportionate percentage of adults that experience chronic mental health problems fall into this population. Also important to note, greater percentages of the U.S. adult population with chronic conditions, such as liver conditions, weak or failing kidneys, chronic bronchitis, or chronic obstructive pulmonary disease, are delayed in accessing NEM care due to transportation issues.

Table 9: Percentage of the Sample Adult Population Experiencing Medical Condition and Who Answered Yes to Being Delayed in Accessing NEM Care Due to Transportation from 2015 NHIS

Medical Condition	Unweighted Percentage of Population Experiencing the Medical Condition Who Are Also Unable or Delayed in Obtaining NEM Care Due to Transportation (%)	Weighted Percentage of Population Experiencing the Medical Condition Who Are Also Unable or Delayed in Obtaining NEM Care Due to Transportation (%)
Joint pain/aching/stiffness (JNTSYMP)	3.74	3.19
Hypertension (HYPEV)	3.65	3.15
Arthritis (ARTH1)	4.14	3.49
High Cholesterol (CHLEV)	3.22	2.59
Asthma (AASMEV)	4.65	3.95
Diabetes (DIBEV)	4.62	4.27
Sinusitis (SINYR)	3.60	2.88
Carpal Tunnel Syndrome (CTSEVER)	4.81	3.97
Depression/anxiety/emotional problem/other mental health problem that causes difficulty with activity (AFLHCA17 + AFLHC30_)	11.64	16.24
Ulcer (ULCEV)	5.22	4.37
Cancer (CANEV)	3.16	3.02
Heart Condition/Disease (HRTEV)	4.60	3.34
Chronic Bronchitis (CBRCHYR)	8.10	6.60
Nervous (ASINERV)	12.33	12.18
Restless/Fidgety (ASIRSTLS)	9.53	8.37
Felt Like Everything was an Effort (ASIERFRT)	10.73	7.67
Hay Fever (AHAYFYR)	3.25	2.35
COPD (COPDEV)	7.52	6.08
Weak/Failing Kidneys (KIDWKYR)	8.81	7.67
Coronary Heart Disease (CHDEV)	4.48	3.32
Stroke (STREV)	6.49	5.30
Heart Attack (MIEV)	5.33	4.28
Vision/Problem seeing causes difficulty with activity (AFLHCA1)	10.46	8.16
Liver Condition (LIVYR)	8.70	7.57
Seizure Disorder/Epilepsy (EPILEP1)	8.35	6.10
Emphysema (EPHEV)	9.81	8.04
Worthless (ASIWTHLS)	14.92	13.21
Angina Pectoris (ANGEV)	6.99	5.23
Sad (ASISAD)	14.15	11.77

Hearing Aid (HRAIDNOW)	1.82	2.29
Hopeless (ASIHOPLS)	14.43	9.06
Problems with Circulation (AFLHC21_)	9.56	7.09
Crohn's Disease/Ulcerative Colitis (ULCCOLEV)	5.95	4.81
Urinary Problems (AFLHC25_)	11.45	7.56

Table 10 details the prevalence of 34 medical conditions experienced by American adults who experienced delays in accessing NEM care due to transportation issues in comparison to the prevalence of those conditions in the total weighted U.S. adult population. It is notable that the prevalence of **every** medical condition analyzed is higher in the population that is delayed in obtaining NEM care due to transportation in comparison to the overall population. Of the top ten most prevalent medical conditions in the population of adults who are delayed accessing NEM due to transportation, seven are chronic conditions and require frequent medical attention. This includes joint pain/aching/stiffness that occurs in almost 60% of the population of adults who are delayed accessing NEM due to issues with transportation, as well as hypertension, arthritis, high cholesterol, asthma, diabetes, and depression, which occur in 53%, 43%, 39%, 27%, 22%, and 16% of this population respectively.

Table 10: Health Characteristics of Sample Adults Who Answered Yes to Experiencing Delays to NEM Care Due to Transportation Compared to the Total Sample Adult from 2015 NHIS

Medical Condition	Weighted Prevalence in the Population Unable or Delayed in Obtaining NEM Care due to Transportation (%)	Weighted Prevalence in Total Sample Population (%)	Ratio of Prevalences
Joint pain/aching/stiffness (JNTSYMP)	59.16	33.79	1.75
Hypertension (HYPEV)	53.79	31.12	1.73
Arthritis (ARTH)	43.73	22.84	1.92
High Cholesterol (CHLEV)	39.06	27.39	1.43
Asthma (AASMEV)	27.34	12.62	2.17
Diabetes (DIBEV)	22.38	9.55	2.34
Sinusitis (SINYR)	19.09	12.11	1.58
Carpal Tunnel Syndrome (CTSEVER)	17.13	7.87	2.18
Depression/anxiety/emotional problem/ other mental health problem that causes difficulty with activity (AFLHCA17 + AFLHC30_)	16.16	6.62	2.44
Ulcer (ULCEV)	14.62	6.09	2.40
Cancer (CANEV)	14.41	8.71	1.65
Heart Condition/Disease (HRTEV)	14.41	7.86	1.83
Chronic Bronchitis (CBRCHYR)	13.85	3.82	3.63
Nervous (ASINERV)	13.53	2.02	6.69

Restless/Fidgety (ASIRSTLS)	12.68	2.76	4.59
Felt Like Everything was an Effort (ASIERFRT)	12.29	2.92	4.21
Hay Fever (AHAYFYR)	10.64	8.24	1.29
COPD (COPDEV)	10.39	3.12	3.33
Weak/Failing Kidneys (KIDWKYR)	8.45	1.99	4.25
Coronary Heart Disease (CHDEV)	8.24	4.52	1.82
Stroke (STREV)	7.83	2.69	2.91
Heart Attack (MIEV)	7.34	3.13	2.35
Vision/ Problem seeing causes difficulty with activity (AFLHCA1)	7.19	3.29	2.19
Liver Condition (LIVYR)	6.75	1.62	4.17
Seizure Disorder/Epilepsy (EPILEP1)	6.56	1.96	3.35
Emphysema (EPHEV)	6.39	1.45	4.41
Worthless (ASIWTHLS)	5.60	0.77	7.27
Angina Pectoris (ANGEV)	5.51	1.92	2.87
Sad (ASISAD)	5.40	0.84	6.43
Hearing Aid (HRAIDNOW)	4.09	3.29	1.24
Hopeless (ASIHOPLS)	3.73	0.75	4.97
Problems with Circulation (AFLHC21_)	3.41	1.79	1.91
Crohn's Disease/Ulcerative Colitis (ULCCOLEV)	3.36	1.27	2.65
Urinary Problems (AFLHC25_)	2.32	1.15	2.02

Sample Child Population

Table 11 provides both the unweighted and weighted percentage of the U.S. child sample and total population that experience one of 21 medical conditions and also are unable or delayed in accessing NEM care due to transportation. The data indicates that a disproportionate percentage of children that experience serious medical concerns such as anemia, vision problems, frequent headaches or migraines, diabetes, and ear infections also are delayed in accessing NEM care due to transportation issues.

Table 11: Percentage of the Sample Child Population Experiencing Medical Condition and Who Answered Yes to Being Delayed in Accessing NEM Care Due to Transportation from 2015 NHIS

Medical Condition	Unweighted Percentage of Population Experiencing the Medical Condition Who Are Also Unable or Delayed in Obtaining NEM Care Due to Transportation (%)	Weighted Percentage of Population Experiencing the Medical Condition Who Are Also Unable or Delayed in Obtaining NEM Care Due to Transportation (%)
Hay Fever (HAYF1 + HAYF2)	2.54	2.23
Head/Chest Cold Over Past 2 Wks (CCOLD2W)	2.87	3.09

Frequent Diarrhea/Colitis (DIARH1 + DIARH2)	3.23	1.61
Learning Disability (LEARND)	5.55	4.73
Food/Digestive Allergies (DALLG1 + DALLG2)	1.50	0.91
Asthma (CASHMEV)	2.60	2.30
ADHD/ADD (ADD2)	3.48	2.90
Ear Infections 3+ In Past 12 M (EARINF1 + EARINF2)	3.99	4.41
Frequent Headaches/Migraines (FHEAD)	5.03	4.15
Chicken Pox (CPOX)	2.81	2.85
Vision Problems (CVISION)	4.11	5.54
Respiratory Allergies (RALLG1 + RALLG2)	2.85	2.63
Stutter/Stammer (STUTTER)	6.35	4.36
Been Unhappy/Depressed in the Last 2 M – Sometimes True (CMHAGM15)	2.27	0.68
Eczema/Skin Allergies (SALLG1 + SALLG2)	2.56	2.55
Anemia (ANEMIA1 + ANEMIA2)	5.63	5.48
Autism, Asperger's, Pervasive Development or Autism Spectrum Disorder (AUTISM)	2.44	1.55
Other Heart Condition (CCONDRR9)	4.88	3.60
Diabetes (CCONDRR6)	6.45	4.93
Cerebral Palsy (CCONDRR2)	7.14	1.41
Arthritis (CCONDRR7)	7.69	0.64

Table 12 details the prevalence of 21 medical conditions experienced by American children, ages 0-17 years, who noted experiencing delays to NEM care due to transportation issues in comparison to the prevalence of those conditions in the total weighted U.S. child population. With the exception of 5 variables (Been Unhappy/Depressed in the Last 2 M – Sometimes True; Eczema/Skin Allergies; Autism, Asperger's, Pervasive Development or Autism Spectrum Disorder; Cerebral Palsy; and Arthritis) each medical condition once again has a higher prevalence in the population of children delayed in obtaining NEM care due to transportation in comparison to the overall population. Of the top most prevalent medical conditions in the population of children who are delayed accessing NEM due to transportation, many can be dangerous for children if medical attention is not provided in a timely manner.

Table 12: Health Characteristics of Sample Children Who Answered Yes to Experiencing Delays to Medical Care Due to Transportation Compared to the Total Sample Child from 2015 NHIS

Medical Condition	Weighted Prevalence in Population Unable or Delayed in Obtaining Medical Care due to Transportation (%)	Weighted Prevalence in Total Sample Population (%)	Ratio of Prevalences
Hay Fever (HAYF1)	51.21	32.32	1.58
Head/Chest Cold Over Past 2 Wks (CCOLD2W)	26.29	15.26	1.72
Frequent Diarrhea/Colitis (DIARH1)	23.51	13.09	1.80
Learning Disability (LEARND)	21.15	7.45	2.84
Food/Digestive Allergies (DALLG1)	18.35	4.42	4.15
Asthma (CASHMEV)	16.69	12.99	1.28
ADHD/ADD (ADD2)	15.49	9.23	1.68
Ear Infections 3+ In Past 12 M (EARINF1)	14.01	10.1	1.39
Frequent Headaches/Migraines (FHEAD)	13.74	5.52	2.49
Chicken Pox (CPOX)	13.14	8.27	1.59
Vision Problems (CVISION)	7.89	2.56	3.08
Respiratory Allergies (RALLG1)	6.80	3.71	1.83
Stutter/Stammer (STUTTER)	5.22	1.99	2.62
Been Unhappy/Depressed in the Last 2 M – Sometimes True (CMHAGM15)	4.57	6.90	0.66
Eczema/Skin Allergies (SALLG1)	3.76	6.03	0.62
Anemia (ANEMIA1)	3.69	1.61	2.29
Autism, Asperger's, Pervasive Development or Autism Spectrum Disorder (AUTISM)	2.08	2.31	0.90
Other Heart Condition (CCONDRR9)	2.02	1.01	2.00
Diabetes (CCONDRR6)	0.71	0.26	2.73
Cerebral Palsy (CCONDRR2)	0.25	0.31	0.81
Arthritis (CCONDRR7)	0.04	0.11	0.36

Summary of Key Findings

Size Estimate of Target Population

The updated size estimate of the U.S. population that is delayed in accessing medical care due to issues with transportation came from analysis of 2015 NHIS and MEPS data and is provided below. Due to limitations associated with the 2015 MEPS questions, the final MEPS size estimate of the target population was not considered in this analysis.

2005 Hughes-Cromwick et al. Estimate	2015 Current Study Estimate
3,600,000 Americans	**10,128,481 Americans**
1.2% of the U.S. Population[lxvii]	**3.2% of the U.S. Population[lxviii]**

The current 2015 estimate represents more than a 280% increase in the number of Americans who were delayed in obtaining NEM care due to transportation from the 2005 Hughes-Cromwick et al. estimate. The current estimate also represents a percentage of the U.S. population that are delayed in accessing medical care due in part to transportation that is more than double the 2005 percentage.

It is important to remember that the 2015 estimate is likely high due to limitations of the NHIS data source, but the non-linear increase in the current estimate from 2005 indicates that there is still a significant amount that needs to be done to meet the growing needs of NEMT in the United States.

Demographic Characteristics of Target Population

The U.S. adult population, over 18 years, with that is delayed in accessing NEM care due to issues with transportation issues is disproportionately female, older, and minority. The following are key findings from the demographic characteristics analysis. Comparisons to the 2005 Hughes-Cromwick et al. study are included in this summary, but are not provided in a comparison table due to differences in the data analyzed.

Target Adult Population Demographic Percentage of the U.S. Population

- Of all adult women in the U.S. in 2015, 2.31% were delayed in accessing NEM care due to issues with transportation, compared with only 1.29% of all U.S. men.
- 7.16% of all Indian (American), Alaska Native in the U.S. in 2015 were delayed in accessing NEM care due to issues with transportation, compared with only 1.53% of all Whites and Black or African Americans in the U.S.
- 2.11% of all Americans were delayed in accessing NEM care due to issues with transportation in 2015 were from the Midwest, almost 11% more than any other region in the U.S.
- 2.42% of all 55-64 year olds and 1.67% of all 65+ year olds in the U.S. were delayed in accessing NEM care due to issues with transportation in 2015.

Target Adult Population Demographic Characteristics

- 27% more females were in the target population in 2015 compared to the total U.S. population. This is an increase from 2006, when females made up only 21% more of the target population than the total U.S. population.
- The percentage of Black or African Americans in the 2015 target population was almost double that in the total U.S. population. This is compared to only 7% more Black or African Americans present in the 2006 target population compared to the total U.S. population at the time.
- The percentage of Indian (American), Alaska Native in the 2015 target population is almost 4 times the percentage in the total U.S. population.
- The percentage of Whites in the 2015 target population is 19% lower in the target population than in the total U.S. population.
- The percentage of 55-64 year olds in the 2015 target population is almost 30% greater than the percentage in the total U.S. population.

Target Child Population Demographic Percentage of the U.S. Population

- Of all female children in the U.S. in 2015, 2.07% were delayed in accessing NEM care due to issues with transportation, compared with 1.53% of all U.S. male children.
- 3.07% of all Indian (American), Alaska Native children and 3.67% of all Black or African American children were delayed in accessing NEM care due to issues with transportation, compared with 1.45% of all White children in 2015.

- 2.06% of all children who were delayed in accessing NEM care due to issues with transportation in 2015 were from the South.
- 2.13% of all 0-4 year olds who were delayed in accessing NEM care due to issues with transportation in 2015, a percentage 19% greater than any of the other age groups.

Target Child Population Demographic Characteristics

- 16% more female children were in the target population in 2015 compared to the total U.S. population.
- The percentage of Black or African American children in the 2015 target population was almost double that in the total U.S. population.
- The percentage of Indian (American), Alaska Native children in the 2015 target population is almost double the percentage in the total U.S. population.
- The percentage of White children in the 2015 target population is almost 25% lower than in the total U.S. population.
- The percentage of children from the South in the 2015 target population is about 13% more than in the total U.S. population.
- The percentage of children from the Northeast in the 2015 target population is almost a third less than in the total U.S. population.
- The percentage of 0-4 year olds in the 2015 target population is almost 19% greater than the percentage in the total U.S. population.

Health Characteristics of Target Population

Percentage of U.S. Adult Population With Health Characteristic in Target Population

- 16.24% of all adults in the U.S. in 2015 with depression/anxiety/emotional problems/other mental problems were delayed in accessing NEM care due to issues with transportation.

Target Adult Population Health Characteristics

- The prevalence of all 34 medical conditions analyzed in the 2015 study was higher in the target population than in the total U.S. population. This is consistent with the 2006 study findings.
- In particular, diabetes, asthma, carpal tunnel, ulcers, and Crohn's Disease/ulcerative colitis were more than twice as prevalent in the target population; chronic bronchitis and COPD were almost 3.5 times as prevalent in the target population; weak/failing kidneys, liver conditions, emphysema were more than 4 times as prevalent in the target population, compared to the total U.S. population in 2015.
- Notably, depression and mental health conditions, such as feelings of being sad, worthless, restless/fidgety, among others were considerably higher in the target population, almost all more than 5 times the prevalence in the total U.S. population.
- Seven of the top ten medical conditions affecting the target population are chronic, which is consistent with findings from the 2005 study.

Percentage of U.S. Child Population With Health Characteristic in Target Population

- Of all children in the U.S. in 2015, those with anemia, diabetes, stutter, vision problems, frequent headaches/migraines, ear infections, and learning disabilities were more likely to experience delays in accessing NEM care due to issues with transportation.

Target Child Population Health Characteristics

- The prevalence of each of the 21 medical condition analyzed in the 2015 study were higher in the target population than in the total U.S. population, with the exception of 5 conditions. This finding is similar to that found in the 2006 study.

Discussion

The current study provides an updated estimate of the size of the U.S. population that is delayed in accessing NEM care due to issues with transportation, as well as provides demographic and health characteristics of this target population. The findings from the analysis indicate that the size of the target population has increased non-linearly since 2005, with the 2015 U.S. estimate now 3.2% of the U.S. population, a much larger figure than in 2005. This finding is consistent with the original hypothesis that the target population would grow in size from 2005 to 2015. While the 2015 estimate may be overstated due to limitations with the NHIS dataset, it is clear that efforts to mitigate reduced or lack of access to NEMT needs to increase in order to keep up with growth of the population that is delayed in accessing NEM care due to issues with transportation.

The demographic characteristics of the 2015 U.S. population that were delayed in accessing medical care due to issues with transportation, were found to be disproportionately female, minority, and either older (age 55-64 years) or considerably younger (0-4 years). Interestingly, in the current 2015 study, children in the target population were disproportionately from the South and not from the Northeast in comparison to the total U.S. child population. This may have to do with more connected and extensive public transportation systems in the U.S. Northeast compared to the South.

The adult portion of the demographic analysis is relatively consistent with the demographic characteristics from the 2005 Hughes-Cromwick et al. study (the demographics of children were not assessed in 2005). While analysis shows that demographic disparities between the target adult population and the total U.S. adult population are worse in 2015 than in 2005, it is not reasonable to compare these characteristics as the 2005 study assessed unweighted variables and the 2015 study assessed weighted variables. However, the demographic disparities in the target population are clear in comparison to the total U.S. population and need to be considered in the development of potential solutions to NEMT access. Such consideration will help to eliminate adverse health outcomes for the target population and improve equity in access to healthcare.

The current study findings of the health characteristics of the 2015 U.S. population that were delayed in accessing medical care due to issues with transportation indicates that this population experienced a disproportionate burden of both chronic and acute medical conditions compared to the total U.S. population. Of those conditions, chronic health concerns represented a majority of the top ten most prevalent health conditions in the 2015 U.S. adult target population. Depression and mental health problems were also highly and disproportionately prevalent in the target population compared to the total U.S. population.

The types of medical conditions that are most prevalent in the 2005 target population compared with the 2015 target population are largely similar, but the prevalence rate of each condition has mostly increased from 2005. This indicates that prevalence of many chronic conditions may have increased in the target population over the past decade and a half. Similar to demographic characteristics, the disproportionate burden of health conditions present in the 2015 target population needs to be taken into account when developing solutions to lack of NEMT. In order to improve health outcomes in the target population, reliable, consistent, and affordable transportation options need to be available.

Current Solutions to Address Delays in NEM Care Due to Transportation

Due to the economic and health burden produced by missed or delayed medical appointments as a result of transportation issues and/or lack of adequate access to NEMT in the U.S., many companies, organizations, and governments have been working hard to develop sustainable and innovative solutions to improve NEMT access for the target and whole U.S. population. The following represent just a few of the promising ideas that may improve access to transportation to NEM appointments and healthcare generally throughout the U.S.

Telehealth

Telehealth is "the use of technology to deliver health care, health information or health education at a distance" and can include either real-time communication or the use of imaging and data transmission between patients and physicians.[lxix] Telehealth allows patients who may have trouble accessing transportation to NEM appointments or may be reluctant to receive care due to distance or cost, the opportunity to seek care without leaving the home. For example, Blue Cross and Blue Shield of North Carolina recently formalized a partnership with MDLIVE to offer safe and secure medical visits online. MDLIVE doctors are able to diagnose common health problems in patients, prescribe medications and send prescriptions all through secure, online chats 24 hours a day/7 days a week. MDLIVE is meant to save patients money and promote preventative care without the need to travel to the doctor.[lxx] In fact, current research notes that telehealth visits may cost approximately half of a clinic visit and less than five percent of the cost of an emergency department visit.[lxxi] Of course a key limitation of telehealth is that patients must have access to a mobile device, tablet, or computer, as well as secure and functional Internet access in order to use the service. For the target population of this study, these requirements may not always be feasible.

Car-sharing Medicaid Brokerage

Under federal Medicaid regulations, State Medicaid Agencies (SMAs) are required to provide necessary transportation for beneficiaries to and from providers.[lxxii]Many states choose to provide this service by hiring independent contractors or "brokers" to provide NEMT to Medicaid recipients. While there are many models for how SMAs manage and/or broker Medicaid NEMT, recently some states have started using on-demand car-sharing services to provide this service.[lxxiii] For example, in 2016, an NEMT-focused, car-sharing start-up, named Veyo, won the competitive bid to provide almost 100% of Medicaid NEMT trips for the state of Idaho.[lxxiv] Veyo is now operating in 8 states and is claiming $7 million in savings for healthcare patients.[lxxv]

Other car-sharing services such as Uber and Lyft are also beginning to enter into brokerage partnerships to provide NEMT to Medicaid recipients. One such partnership occurred in 2017, when LogistiCare, the nation's largest NEMT manager entered into a 3-year partnership with Lyft to provide enhanced service to Medicaid recipients across the country. Lyft is able to provide immediate and on-demand NEMT in the areas where it is located.[lxxvi] Similar to telehealth however, technology may be a barrier to accessing NEMT through app-based companies like Lyft, Uber and Veyo, especially for those in the target population. Innovations in coordinating rides for car-sharing services already exist and will need to continue in order to make car-sharing via apps a viable NEMT option. This type of partnership between NEMT providers and car-sharing services is also only available currently through Medicaid, which does reach all of the target population of this study. Future innovations similar to these partnerships will be useful for Americans who need transportation to NEM appointments beyond just Medicaid recipients.

Mobility Management

Mobility management is a tactic used by communities across the country to more effectively and efficiently coordinate transportation in a local area. Often mobility managers are housed within county or city

government, and offer a one-stop shop for information and support with transportation services. Mobility management can be especially useful with regards to NEMT, as managers can provide information and assistance to individuals unsure of how to get to medical appointments or unable to access necessary transportation. Mobility managers are often able to order car-sharing or taxi services for clients, look up public transit schedules and provide detailed information about routes and timing, and at times even provide in-person support in helping individuals get where they need to go. Mobility management can be built upon in the future to provide even more targeted information and support for NEMT in a local area.[lxxvii]

Chronic Disease Self-Management Education

While not addressing transportation directly, chronic disease self-management education (CDSME) courses teach individuals how to more effectively manage their chronic conditions without needing to always visit the doctor. This creative solution to reducing the need for people to travel to healthcare appointments, has been in existence since 2003 and is supported by the U.S. Administration on Aging. CDSME programs currently exist in 22 states in-person and online. By combining CDSME with telehealth technology there is the opportunity in the future to drastically reduce the number of patients that need to travel to NEM appointments, thus reducing the need for NEMT.[lxxviii]

Limitations & Differences Between Studies

Numerous limitations were present in this study. First, the definition of the target population presented at the beginning of this paper, while based on literature, is arbitrary and not without gaps. For instance, not everyone with lack of physical access to a personal vehicle and/or public transit has difficulty accessing NEM care. Some people may have a caregiver or friend who is able to transport them reliably to medical appointments, while others may have the means and ability to use car-sharing services when needed. Additionally, the expense of transportation, while current evidence exists, could use more research to strengthen the argument for this as a barrier to accessing NEM appointments. Time and distance required to access an NEM appointment, similarly could use more research as current evidence is mixed and indicates that perceived time and distance may be the more realistic barrier.

While the intent of this study was to use the 2005 Hughes-Cromwick et al. methodology to update the estimate of the U.S. population that is delayed in accessing NEM care due to issues with transportation, only NHIS data was able to be used for the final estimate due to substantial changes to the MEPS questionnaire. In the 2001 MEPS questionnaire used for the 2005 Hughes-Cromwick et al. study, the survey question of interest asked for the reason that a person had difficulty in obtaining care, with three answers used for the analysis: medical care too far away, cannot drive/no car/no public transportation, and too expensive to get there. In the 2015 MEPS dataset that was used for the updated analysis, while the same question as in 2005 was used for analysis, none of the same transportation-specific responses were included, or even transportation-specific responses at all. For this reason, it was decided to exclude the MEPS estimate of the U.S. population that misses or is delayed in accessing NEM care due to transportation and to move forward with only the NHIS estimate.

While the NHIS is a nationally-representative and reputable survey, an inherent limitation with using only one data source to produce the final estimate of the U.S. population that is delayed in accessing NEM care due to issues with transportation is that it produces only one possible value. Triangulation of the final estimate would have likely improved the accuracy and reliability of this figure. In addition, the NHIS estimate is likely high due to possible double counting between children and adults if parents reported delays in obtaining medical care due to transportation in the adult survey for their children.

Following the methodology presented in the 2005 Hughes-Cromwick et al. study, the NHIS dataset was used to examine the demographic and health characteristics of the U.S. population that is delayed in accessing NEM care due to issues with transportation. However, between 2001-2002 to 2015 the NHIS questionnaire changed their survey to no longer include the income, educational attainment, or geographic location variables that were assessed in the 2005 study. For this reason, these variables could not be compared between the 2005 to the current study. Further, the 2005 study did not look into child demographic data while the current 2015 study did.

Following the methodology presented in the 2005 Hughes-Cromwick et al. study, NHIS data was again used to examine the health characteristics of the U.S. population that is delayed in accessing NEM care due to issues with transportation. From 2005 to 2015, 16 of 43 adult health conditions assessed in the original 2005 study were unavailable in 2015. In contrast, eight additional health variables were added to the 2015 assessment that were not included in 2005. For the child health analysis, six health variables previously analyzed in 2005 had missing data and thus were excluded from the 2015 assessment, while three additional health variables were included.

In regards to medical conditions assessed in the current study, weighted percentages and prevalences were provided to convey a more complete understanding of the target population compared to the U.S. population. However, in the 2005 Hughes-Cromwick et al. study, medical conditions experienced by both adults and children were presented as unweighted frequencies and prevalences, making them difficult to compare across the years.

Conclusion

In 2005, Hughes-Cromwick et al. conducted a study that assessed the size of the U.S. population that lacked access to NEM care due to transportation issues as well as the socio-demographic and health characteristics of this population in order to inform a cost-benefit analysis of NEMT in the U.S. Since this study was published, the resulting estimate of 3.6 million Americans that lack of access to NEMT has been widely cited in articles and research, and is consistently used to justify new NEMT programs, government spending, and healthcare policy. However, the data used for the 2005 study is from 2001-2002 and is currently over 15 years out of date.

This study aimed to update the size estimate, demographic and health characteristics of the U.S. population that is delayed in accessing NEM care due to transportation issues in order to provide more relevant and reliable data to inform arguments for increased and more equitable NEMT options in the U.S. The key findings from this study include:

- As of 2015, approximately 10,128,481 Americans, or 2.3% of the U.S. population, were delayed in accessing NEM care due to issues with transportation. This is a 280% increase from the 2005 Hughes-Cromwick et al. estimate.
- Consistent with the 2005 Hughes-Cromwick et al. study, the 2015 U.S. population that experienced delays in accessing NEM care due to issues with transportation was disproportionately female, minority, and older. Not consistent with the 2006 study due to lack of analysis, this population was also disproportionately younger (0-4 years).
- Consistent with the 2005 Hughes-Cromwick et al. study, the prevalence of each of the 34 acute and chronic medical conditions analyzed in the adult population in this study was higher in the target population than in the total U.S. population.

- Also consistent with the 2005 Hughes-Cromwick et al. study, the seven of the top ten most prevalent medical conditions in the target population for this study were chronic, with depression and mental health issues being of conditions of considerable concern.

The findings from this study build upon and confirm many of the results of the 2005 Hughes-Cromwick et al. analysis. Unfortunately, the current findings do not indicate that the target population has reduced in size over the past 16-17 years, nor has become any more equitable in demographic and health characteristics in comparison to the total U.S. population. While limitations in the comparison of the two studies need to be considered, this study, if anything, indicates that the size and disparities in the target population are only getting worse.

New, innovative and sustainable solutions to improve access to transportation to NEM appointments, particularly for the vulnerable target population, are essential in order to maintain and improve long-term health outcomes throughout the country, as well as reduce healthcare costs to the individual and the medical community. This study is meant to provide a foundation to begin exploring such solutions to NEMT access and ultimately reduce the size and disparities of the U.S. population that is delayed in accessing NEM care due to issues with transportation.

APPENDIX A

The following code was recommended by the 2015 National Health Interview Survey (NHIS) Survey Description and was used to apply the national population weight variable to each dataset:

Sample Adult Data:

```
PROC SURVEYFREQ;
WEIGHT WTFA_SA;
TABLES AHCDLYR5;
RUN;
```

Sample Child Data:

```
PROC SURVEYFREQ;
WEIGHT WTFA_SC;
TABLES CHCDLYR5;
RUN;
```

APPENDIX B

The first question analyzed from the 2015 MEPS is AC34 from the 2015 MEPS-HC dataset, and refers to the following:

> **[This question was asked if the respondent replied yes to the question: in the last 12 months, was anyone in the family *unable* to obtain medical care, tests, or treatments they or a doctor believed necessary?] Which of these best describes the main reason {you/{PERSON}} {were/was} unable to get medical care, tests, or treatments {you/he/she} or a doctor believed necessary?**

1 Couldn't afford care
2 Insurance company wouldn't approve, cover, or pay for care
3 Doctor refused to accept family's insurance plan
4 Problems getting to the doctor's office
5 Different language
6 Couldn't get time off work
7 Didn't know where to go to get care
8 Was refused services
9 Couldn't get child care
10 Didn't have time or took too long
91 Other
-7 Ref
-8 DK

The second question in the 2015 MEPS-HC dataset that relates to problems with accessing healthcare due to transportation is AC38, and refers to the following:

> **[This question was asked if the respondent replied yes to the question: in the last 12 months, was anyone in the family *delayed* to obtain medical care, tests, or treatments they or a doctor believed necessary?] Which of these best describes the main reason {you/{PERSON}} {were/was} delayed in getting medical care, tests, or treatments {you/he/she} or a doctor believed necessary?**

1 Couldn't afford care
2 Insurance company wouldn't approve, cover, or pay for care
3 Doctor refused to accept family's insurance plan
4 Problems getting to the doctor's office
5 Different language
6 Couldn't get time off work
7 Didn't know where to go to get care
8 Was refused services
9 Couldn't get child care
10 Didn't have time or took too long
92 Other
-7 Ref
-8 DK

APPENDIX C

The following code was used to apply the national population weight to each variable of interest in the 2015 MEPS-HC-183: MEPS Panel 19 Longitudinal dataset:

Variable MDUNRS2:
```
PROC SURVEYFREQ;
WEIGHT LONGWT;
TABLES MDUNRS2;
RUN;
```

Variable MDUNRS4:
```
PROC SURVEYFREQ;
WEIGHT LONGWT;
TABLES MDUNRS4;
RUN;
```

Variable MDDLRS2:
```
PROC SURVEYFREQ;
WEIGHT LONGWT;
TABLES MDDLRS2;
RUN;
```

Variable MDDLRS4:
```
PROC SURVEYFREQ;
WEIGHT LONGWT;
TABLES MDDLRS4;
RUN;
```

APPENDIX D

The following code was recommended by the 2015 National Health Interview Survey (NHIS) Survey Description to apply the weight variable to each dataset.[lxxix] In addition to applying national weights, in order to isolate the demographic characteristics of only those individuals who missed or were delayed in accessing NEM care due to transportation issues, a crosstabs table was developed in SAS. The following code was used to weight and develop a crosstabs table for each variable.

Sample Adult Data:

```
PROC SURVEYFREQ;
STRATA STRAT_P;
CLUSTER PSU_P;
WEIGHT WTFA_SA;
TABLES AHCDLYR5*
AGE_P; RUN;

PROC SURVEYFREQ;
STRATA STRAT_P;
CLUSTER PSU_P;
WEIGHT WTFA_SA;
TABLES AHCDLYR5*SEX;
RUN;

PROC SURVEYFREQ;
STRATA STRAT_P;
CLUSTER PSU_P;
WEIGHT WTFA_SA;
TABLES AHCDLYR5*
MRACRPI2; RUN;

PROC SURVEYFREQ;
STRATA STRAT_P;
CLUSTER PSU_P;
WEIGHT WTFA_SA;
TABLES AHCDLYR5*
REGION; RUN;
```

Sample Child Data:

```
PROC SURVEYFREQ;
STRATA STRAT_P;
CLUSTER PSU_P;
WEIGHT WTFA_SC;
TABLES CHCDLYR5*
AGE_P; RUN;

PROC SURVEYFREQ;
STRATA STRAT_P;
CLUSTER PSU_P;
WEIGHT WTFA_SC;
TABLES CHCDLYR5*
SEX; RUN;

PROC SURVEYFREQ;
STRATA STRAT_P;
CLUSTER PSU_P;
WEIGHT WTFA_SC;
TABLES CHCDLYR5*
MRACRPI2; RUN;

PROC SURVEYFREQ;
STRATA STRAT_P;
CLUSTER PSU_P;
WEIGHT WTFA_SC;
TABLES CHCDLYR5*
REGION; RUN;
```

APPENDIX E

The following code was recommended by the 2015 National Health Interview Survey (NHIS) Survey Description to apply the weight variable to each dataset.[lxxx] In addition to applying national weights, in order to isolate the health characteristics of only those individuals who missed or were delayed in accessing NEM care due to transportation issues, a crosstabs table was developed in SAS. The following example code for both the Sample Adult and Sample Child datasets was used to weight and develop a crosstabs table for each variable.

Sample Adult Data:

```
PROC SURVEYFREQ;
STRATA STRAT_P;
CLUSTER PSU_P;
WEIGHT WTFA_SA;
TABLES AHCDLYR5*
HYPEV; RUN;
```

Sample Child Data:

```
PROC SURVEYFREQ;
STRATA STRAT_P;
CLUSTER PSU_P;
WEIGHT WTFA_SC;
TABLES CHCDLYR5*
HYPEV; RUN;
```

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